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$$-2 = \frac{c_1}{a_1 \rho \cos \theta + b_1 \rho \sin \theta} + \frac{c_2}{a_2 \rho \cos \theta + b_2 \rho \sin \theta}.$$

Transforming back to rectangular co-ordinates, we have

$$2(a_1x + b_1y)(a_2x + b_2y) + c_1(a_2x + b_2y) + c_2(a_1x + b_1y) = 0$$

for the locus of P . This equation represents a hyperbola passing through the vertex A . Hence the intersection of this hyperbola with the base CB will give R , and PR produced will give T .

CALCULUS.

248. Proposed by REV. R. D. CARMICHAEL, Anniston, Ala.

Evaluate $\int_0^{\frac{1}{2}\pi} \sin nx \cot x \, dx$, where n is a positive integer.

II. Solution by FRANCIS RUST, C. E., Pittsburg, Pa.

$$\sin nx = n \cos^{n-1} x \sin x - \left(\frac{n}{3}\right) \cos^{n-3} x \sin^3 x + \left(\frac{n}{5}\right) \cos^{n-5} x \sin^5 x - \dots$$

$$\therefore \int_0^{\frac{1}{2}\pi} \sin nx \cot x \, dx = n \int_0^{\frac{1}{2}\pi} \cos^n x \, dx - \left(\frac{n}{3}\right) \int_0^{\frac{1}{2}\pi} \cos^{n-2} x \sin^2 x \, dx$$

$$+ \left(\frac{n}{5}\right) \int_0^{\frac{1}{2}\pi} \cos^{n-4} x \sin^4 x \, dx \dots \pm \left(\frac{n}{2r+1}\right) \int_0^{\frac{1}{2}\pi} \cos^{n-2r} x \sin^{2r} x \, dx + \dots$$

Transforming $\int_0^{\frac{1}{2}\pi} \sin^p z \cos^q z \, dz$ by the substitution $\sin z = \sqrt{x}$, we have

$$dz = \frac{dx}{2\sqrt{x(1-x)}}, \text{ and } \int_0^{\frac{1}{2}\pi} \sin^p z \cos^q z \, dz = \frac{1}{2} \int_0^1 x^{\frac{1}{2}(p-1)} (1-x)^{\frac{1}{2}(q-1)} dx \\ = \frac{1}{2} B\left[\frac{1}{2}(p+1), \frac{1}{2}(q+1)\right].$$

$$\therefore \int_0^{\frac{1}{2}\pi} \sin nx \cot x \, dx, \text{ in beta-functions, } = \frac{n}{2} B\left(\frac{n+1}{2}, \frac{1}{2}\right)$$

$$- \frac{1}{2} \left(\frac{n}{3}\right) B\left(\frac{n-1}{2}, \frac{3}{2}\right) + \frac{1}{2} \left(\frac{n}{5}\right) B\left(\frac{n-3}{2}, \frac{5}{2}\right) - \dots$$

Also solved by C. E. White.

250. Proposed by V. M. SPUNAR, East Pittsburg, Pa.

Differentiate $(\log^n x)$.